

### **REMARKS**

Applicants respectfully request that the above application be reconsidered, as amended. Claims 1-20 are currently pending.

The status of the parent application has been updated.

Claim 1 has been amended recite selective chemical milling of a rotationally imbalanced gas turbine engine blisk, wherein the method comprises the step of selectively treating at least one blade of the blisk with a chemical etchant of the metal that the at least one blade is made of for a period of time sufficient to change the at least one of the chord and thickness so that the blisk is rotationally balanced. Support for these amendments can be found in paragraph [0010] at page 4 of the above application.

Claim 7 has also been amended to recite that the subsequent steps are repeated until the blisk is rotationally balanced. Support for this amendment can be found in paragraph [0024] at page 9 and in paragraph [0035] at pages 13-14 of the above application

**A. Response to Rejection of Claims 1 and 9-10 under 35 USC 103(a) as Unpatentable over Alleged Admitted Prior Art (APA), or Alternatively over Lowe, in view of Walker**

At pages 2-4 of the Office Action, Claims 1 and 9-10 have been rejected under 35 USC 103(a) as unpatentable over the alleged “admitted prior art” (APA) at paragraphs [0002]-[0006] of the above application, or alternatively over U.S. Patent 6,077,002 (Lowe), in view of Walker, *Machining Fundamentals* (Walker).

The Office Action concedes that neither the alleged APA, nor Lowe, teaches a method of milling that comprises the step of treating at least one blade of the blisk with a chemical etchant. Instead, the Office Action alleges that page 512, first full paragraph of the left column, of Walker discloses chemical milling to be a complementary process to conventional milling processes to allow for forming parts to “more exact dimensions.” In view of Walker, the Office Action alleges that it would have been obvious to modify the process of Lowe and the alleged APA to include chemical etching (milling) “in order to provide exact dimensions of the blisk, thereby reducing blade-to-blade variations and improving the balance of the blisk.”

Applicants respectfully traverse this rejection of Claims 1 and 9-10, as amended and as currently presented. As taught in the above application (see paragraph [0004] at

pages 1-2), these blisks are typically manufactured from a one-piece solid forging which is conventionally machined using either mechanical machining (mechanical milling) or electrochemical machining (ECM). See also Lowe (column 1, lines 46-59 and column 2, lines 27-33) which describes conventional mechanical milling and ECM methods for making such blisks. Indeed, what the alleged APA, as well as Lowe, create are rotationally imbalanced blisks. In other words, the alleged APA, as well as Lowe, create blisks with the very problem that is corrected by the method of Claims 1 and 9-10.

What the Office Action relies on Walker to teach also suggests a misunderstanding of what is needed to solve the problem of rotationally imbalanced blisks. Walker teaches the use of chemical milling to machine metal parts “to exacting tolerances.” See page 511, right hand column, second paragraph. Achieving “exacting tolerances” is not what is important in creating rotationally balanced blisks. Put differently, blades having “exacting tolerances” relative to each other is neither a necessary, nor sufficient, condition to achieve blisk balance. For example, the blades of the blisk could be exactly the same, but offset from the blisk centerline, thus making the blisk unbalanced.

Unlike Walker, it is not the intention of the claimed invention to make “exact” blades within the blisk, but to alter the blade (or blades) of the blisk as required to change the blisk from an unbalanced to a balanced configuration. Put differently, to correct the rotational balance problem of blisks, the dimensional characteristics (i.e., the chord and/or thickness) of one or more blades are changed (and thus the mass of the blade(s)) to achieve balance of the blisk about its rotational center. That is what chemical milling according to Claims 1 and 9-10 accomplishes by adjusting the chord and/or thickness of the blisk blades. See paragraph [0012] at page 5 of above application. In other words, what the method of Claims 1 and 9-10 does is to change the mass distribution of the blades to create a balanced blisk, even if the blades are not within “exacting tolerances” to each other.

The Office Action also improperly combines the teachings of Walker with those of the alleged APA and Lowe. To properly combine the teachings of Walker with those of the alleged APA and Lowe, the Examiner must allege some proper motivation for one skilled in the art to do so. See, e.g., *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988) (“teachings of references can be combined only if there is some suggestion or incentive to do so”); *In re Dance*, 160 F.3d 1339, 1343, 48 U.S.P.Q.2d 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, suggestion, or teaching of the

desirability of making the specific combination that was made by the applicant).

The Office Action alleges no proper “motivation to combine” Walker with the alleged APA and Lowe. First, the Office Action alleges no “motivation” in the alleged APA or Lowe for why one skilled in the art would consider the teachings of Walker to be relevant. In other words, the Office Action is considering the combination of Walker with the alleged APA and Lowe backwards relative to the proper legal standard for “motivation to combine.”

Moreover, relative to the process disclosed in Walker for achieving “exacting tolerances,” the chemical milling process defined in Claims 1 and 9-10 is, instead, a different process, i.e., one that changes the mass distribution of the blades to correct the rotational balance of the blisk. In particular, the Office Action’s suggestion that forming a blisk to “more exact dimensions” will necessarily lead to “improving the balance of the blisk” finds no support in Walker, or any of the other art relied on by the Office Action. Indeed, nowhere does Walker teach that chemical milling can be used to achieve rotational balance of any part, much less a blisk.

That Walker is not directed at correcting rotational imbalances in blisks is further demonstrated by what applications of chemical milling are specifically exemplified in this reference. In Figure 28-2, Walker exemplifies the use of chemical milling for etching the outer skin of an aircraft engine housing, not a gas turbine blade such as a blisk blade. In Figure 28-3, Walker exemplifies the use of chemical milling in making multiple depth cuts, not in adjusting the dimensions of a formed part such as a blisk blade. There is simply nothing specifically exemplified in Walker that would motivate one skilled in the art to apply chemical milling to the problem of adjusting the dimensions (i.e., the chord and/or thickness) of blisk blades according to the process of Claim 11 to correct rotational imbalances in such blisks.

In rejecting Claim 9, the Office Action refers to and relies on the alleged APA at paragraphs [0005]-[0006] of the above application to teach steps (a) through (d). Such reliance on the alleged APA at paragraphs [0005]-[0006] of the above application is misplaced. Nowhere does paragraphs [0005]-[0006] of the above application use wording that is the same or similar to that of steps (a) through (d) in Claim 9. Nor has the Office Action specifically explained, as required by 37 CFR 1.104(c)(2), how what is described in paragraphs [0005]-[0006] of the above application is the equivalent of any or all of steps

(a) through (d) of Claim 9.

Regarding Claim 10, the Office Action concedes that the alleged APA, even in view of Walker, does not teach steps (e) or (f). Instead, the Office Action alleges that it would be obvious to “repeat the process in order to determine that the blisk is balanced,” relying on *Ex parte Rubin*, 128 USPQ [440] (1959) for the proposition that “the repetition of process steps has been held to have been obvious.”

The Office Action’s reliance on *Ex parte Rubin* for the proposition that a “repetition of process steps has been held to have been obvious” is completely misplaced. What *Ex parte Rubin* said and held was that “it is not inventive to change the order of steps.” See 128 USPQ at 441. Nothing in *Ex parte Rubin* suggests that “repetition of process steps” by itself and without a teaching of such in the art is obvious. Accordingly, the Office Action has provided no proper factual or legal basis for rejecting Claim 10 as obvious over the alleged APA (or Lowe), in view of Walker.

For the foregoing reasons, Claims 1 and 9-10, as amended or as currently presented, are unobvious over the alleged APA or Lowe, even in view of Walker.

**B. Response to Rejection of Claims 2-4 and 11-13 under 35 USC 103(a) as Unpatentable over Alleged APA, or Alternatively over Lowe, in view of Walker and Further in view of Fishter et al.**

At page 4 of the Office Action, Claims 2-4 and 11-13 have been rejected under 35 USC 103(a) as unpatentable over the alleged APA, or alternatively over Lowe, in view of Walker, and further in view of U.S. Patent 4,534,823 (Fishter et al.).

The Office Action concedes that the alleged APA, Lowe and Walker fail to teach a chemical etchant that is an aqueous etchant solution comprising at least one acid selected from hydrofluoric acid, nitric acid, sulfuric acid and mixtures thereof. Instead, the Office Action refers to column 2, lines 14-16 of Fishter et al. to teach that solutions for etching gas turbine superalloys include solutions containing hydrochloric and nitric acid. In view of Fishter et al, the Office Action alleges that it would have been obvious to use a chemical solution containing the acids listed in Claims 2-4 and 11-13 “since the same were known at the time of [the] invention to be suitable for etching superalloy gas turbine materials.”

Applicants respectfully traverse this rejection of Claims 2-4 and 11-13, as amended and as currently presented. The Office Action has again improperly combined the

teachings of Fishter et al. with those of Walker, the alleged APA and Lowe by failing to allege some proper motivation for one skilled in the art to do so. First, the Office Action alleges no “motivation” in Walker, the alleged APA or Lowe for why one skilled in the art would consider the teachings of Fishter et al. to be relevant.

In addition, there is no proper motivation in Fishter et al. for combining the teachings of this reference with those Walker, the alleged APA and Lowe according to the method of Claims 2-4 and 11-13. Fishter et al. only teaches the use of chemical milling to remove the recast layer formed by laser or electron beam drilling, or by electric discharge machining (EDM), of a superalloy. See column 1, lines 8-12, and column 2, lines 34-51. In other words, the Fishter et al. process simply removes an impurity from the part, rather than altering the shape of that part. See column 2, lines 38-40 and 52-54. Removal of such impurities according to the Fishter et al. process would in no way teach or suggest chemical milling, even with aqueous etchant solutions, to adjust the dimensions (i.e., the chord and/or thickness) of blisk blades according to the process of Claims 2-4 and 11-13 to correct rotational imbalances in such blisks.

For the foregoing reasons, Claims 2-4 and 11-13, as amended or as currently presented, are unobvious over the alleged APA or Lowe, in view of Walker, even in view of Fishter et al.

**C. Response to Rejection of Claims 5-7 and 14-17 under 35 USC 103(a) as Unpatentable over Alleged APA, or Alternatively over Lowe, in view of Walker, in view of Fishter et al. and Further in view of Blake**

At pages 4-5 of the Office Action, Claims 5-7 and 14-17 have been rejected under 35 USC 103(a) as unpatentable over the alleged APA, or alternatively over Lowe, in view of Walker, in view of Fishter et al., and further in view of U.S. Patent 5,126,005 (Blake).

The Office Action concedes that the alleged APA, Lowe, Walker and Fishter et al. fail to teach immersing at least two blades of the blisk in the etchant solution, where at least one blade is to be treated with the solution, and where at least one blade is not to be treated with the solution, by applying (prior to immersion) to the surfaces of the blade not to be treated a maskant that is chemically resistant to the solution. Instead, the Office Action relies on Blake to allegedly teach that a plastic film may be applied prior to immersion in a chemical solution in order protect regions of a metal part in which chemical

milling is not desired (referring to column 2, lines 7-50), and to allegedly teach that it is known to remove the maskant and repeat the etching process (referring to column 1, lines 30-44). In view of Blake, the Office Action alleges that it would have been obvious to modify the process of the alleged APA or Lowe (in view of Fishter et al.) to immerse at least two blades in the solution and to selectively mask areas of the turbine blades “because this will allow for etching selected portions of the blades without having to move the blisk thus decreasing processing time.” The Office Action also alleges that it would have been obvious to remove the maskant and repeat the etching process in order to remove material from the desired portions of the blades, “thereby balancing the blisk through the etching process.”

Applicants respectfully traverse this rejection of Claims 5-7 and 14-17, as amended and as currently presented. The Office Action has again improperly combined the teachings of Blake with those of Fishter et al., Walker, the alleged APA and Lowe by failing to allege some proper motivation for one skilled in the art to do so. First, the Office Action alleges no “motivation” in Fishter et al., Walker, the alleged APA or Lowe for why one skilled in the art would consider the teachings of Blake to be relevant.

In addition, there is no proper motivation in Blake for combining the teachings of this reference with those of Fishter et al., Walker, the alleged APA and Lowe according to the method of Claims 5-7 and 14-17. The purpose of the Blake process is to eliminate pitting of surfaces of the part (e.g., airplane skin) during etching, rather than to adjust the dimensions of the part. See column 1, lines 7-9 and 64-66. The Blake process would in no way teach or suggest the use of such maskants in a chemical milling process to adjust the dimensions (i.e., the chord and/or thickness) of blisk blades according to the process of Claims 5-7 or 14-17 to correct rotational imbalances in such blisks. In particular, Blake in no way teaches or suggests reimmersing the treated and untreated blades in the etchant solution after removal of the maskant according to Claims 7 or 16.

For the foregoing reasons, Claims 5-7 and 14-17, as amended or as currently presented, are unobvious over the alleged APA or Lowe, in view of Walker, in view of Fishter et al., even in view of Blake.

**D. Response to Rejection of Claims 8 and 18-20 under 35 USC 103(a) as Unpatentable over Alleged APA, or Alternatively over Lowe, in view of Walker, in view of Fishter et al. and Further in view of Law**

At pages 5-6 of the Office Action, Claims 8 and 18-20 have been rejected under 35 USC 103(a) as unpatentable over the alleged APA, or alternatively over Lowe, in view of Walker, in view of Fishter et al., and further in view of U.S. Patent 5,259,920 (Law).

The Office Actions concedes that the alleged APA, Lowe, Walker and Fishter et al. fail to teach a reference panel made of the same metal as the blade to be treated that is immersed in the solution to monitor the degree of change in the chord and/or thickness of the blade and the degree of hydrogen absorption. Instead, the Office Action refers to column 1, lines 5-38 of Law to allegedly disclose the use of a reference panel made of the same metal as the at least one blade to monitor the etching rate. In view of Law, the Office Action alleges that it would have been obvious to modify the process of the alleged APA or Lowe (in view of Fishter et al.) to use a reference panel made of the same material as the treated blade “in order to accurately determine the etch rate and thus predict the change in dimensions of the workpiece improving the efficiency of the process.” The Office Action further alleges that it would have been obvious to use the reduction in thickness of the reference panel to predict whether the treated blisk is balanced “since the etch rate of the reference panel inherently predicts the amount of material removed from the workpiece, and thus the balance of the blisk.”

Applicants respectfully traverse this rejection of Claims 8 and 18-20, as amended and as currently presented. The Office Action has again improperly combined the teachings of Law with those of Fishter et al., Walker, the alleged APA and Lowe by failing to allege some proper motivation for one skilled in the art to do so. First, the Office Action alleges no “motivation” in Fishter et al., Walker, the alleged APA or Lowe for why one skilled in the art would consider the teachings of Law to be relevant.

In addition, there is no proper motivation in Law for combining the teachings of this reference with those of Fishter et al., Walker, the alleged APA and Lowe according to the method of Claims 8 and 18-20. The Law process is directed at monitoring the etching of a pattern in the electronically conductive layer of a circuit board, rather than monitoring the change in dimensions of the shape of a part. See column 1, lines 12-17. Etching a pattern in the part (according to Law) is also not equivalent to changing the dimensions of the

shape of the part (according to Claims 8 and 18-20). The Law process would therefore not teach or suggest the use of such a panel to monitor the degree of change in the dimensions (i.e., the chord and/or thickness) and the degree of hydrogen absorption of blisk blades during chemical milling according to the process of Claims 8 and 18-20 to correct rotational imbalances in such blisks.

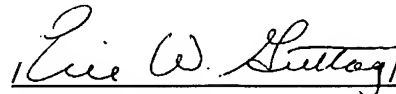
Regarding Claim 19, the Office Action alleges that titanium, steel, nickel, tungsten and alloys thereof are “well known for construction of turbine blades and the like,” referring to Fishter et al., and “would therefore be obvious to use as reference panel metals.” That these metals may be “well known for construction of turbine blades and the like” still fails to address where the art relied on by the Office Action teaches the use of these metals in a reference panel so that the reference panel is made of the same metal as that of the at least one blade according to Claim 19.

For the foregoing reasons, Claims 8 and 18-20, as amended or as currently presented, are unobvious over the alleged APA or Lowe, in view of Walker, in view of Fishter et al., even in view of Law.

**F. Conclusion**

In conclusion, Claims 1-20, as amended or currently presented, are unobvious over the art relied in the Office Action. Accordingly, Applicants respectfully request that the above application be allowed to issue with pending Claims 1-20, as amended or as currently presented.

Respectfully submitted,  
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